2008 INDOT Production Conference

LRFD

Use of Load Factor Resistance Design (LRFD)
Federal Standards

- **New bridges:** required as of October 1, 2007

- **New culverts, retaining walls and other standard structures:** required as of October 1, 2010

- **Modifications to existing structures:** as of October 1, 2007, either the LRFD Specifications or the specifications used for the original design may be used

Use of Load Factor Resistance Design (LRFD)
Indiana Standards

The effective Start Plan Development Date for new and replacement local public development bridges is June 1, 2007.

(Design Memo 06-18 Use of Indiana Design Manual Part VI, Structural Design)

Use of Load Factor Resistance Design (LRFD)
Indiana Standards (cont.)

- This includes all components of the bridge except for pile design and spread-footing sizing.

Use of Load Factor Resistance Design (LRFD)
Indiana Standards (cont.)

- **All bridge rehabs shall be designed in accordance with Part VI of the Indiana Design Manual.**

- **Research is on-going for the design of retaining walls and slope design using LRFD.**

# Use of Load Factor Resistance Design (LRFD)
Indiana Standards (cont.)

- The AASHTO LRFD Bridge Design Specifications, 4th Edition with 2008 Interims will be used for all new or replacement bridges with either design approval or approved Stage 2 plans as of March 18, 2008.

- Pile design and spread footing sizing are to be done using LRFD if the request for geotechnical investigation was made to the Office of Geotechnical Engineering after January 1, 2008.

LRFD Basic Equation

$$\Sigma \, \eta_1 \, \gamma_1 \, Q_1 \le \Phi \, R_n$$

- η_1 = factor relating to ductility, redundancy and operational importance
- γ_1 = load factor
- Q_1 = load or force effects
- Φ = resistance factor
- R_n = nominal resistance
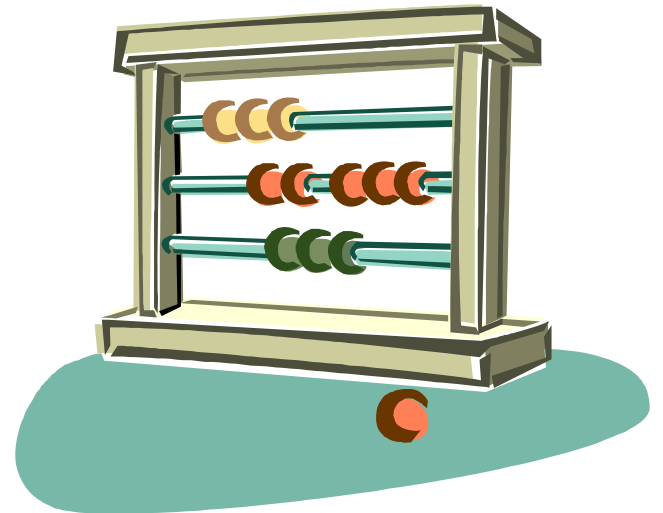
Why use LRFD?

- Incorporates the most recent developments in Bridge Engineering

- Uniform level of safety

- Low life-cycle cost

- Provides flexibility

Why use LRFD? (cont.)

- Consistent with codes developed and used around the world

- Consistent with other areas of structural engineering

- Incorporates working stress design and load factor design as well as extreme events such as earthquakes and floods

Why use LRFD? (cont.)

- The AASHTO Standard Specifications for Highway Bridges 17th Edition, 2002 is no longer being maintained.

AASHTO LRFD Bridge Design Specifications

- 1st Edition was published in 1994

- Current Edition is the 4th and now includes the 2008 interims.

The AASHTO LRFD Bridge Design Specifications are continually being updated.

EX: Recent changes include the updating of the Seismic provisions

Seismic

- 1000 year maps
- No longer just Gibson, Posey and Vanderburg Counties
- Seismic Design Category is now determined by a combination of location and soil type
- Acceleration is now determined at structure not at the rock

Seismic

- Use 4th Edition with '08 Interims
- Guide spec has not been approved for use by INDOT

Differences from the 17th Edition

Vehicular Collision Force

- Clearance to bridge abutments
  - 30' to the roadway edge
  - 50' to the railway centerline

If not, must be designed for a 400 kip equivalent static force

Differences from the 17th Edition

The previous requirement need not be considered if the structure is protected by:

- An embankment
- 54" barrier within 10' of component being protected
- 42" barrier more than 10' from component being protected

Differences from the 17th Edition

Crack Control
- Increased steel requirements

Contacts

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Training

- LRFD Design for Concrete Structures

- LRFD Design for Steel Structures

- Additional Seismic Training

- Online Design Examples Developed by Purdue

Resources

Design Examples located at:

http://www.in.gov/dot/div/contracts/standards/bridges/bridges.html

More info located at:

AASHTO Subcommittee on Bridges and Structures website

http://bridges.transportation.org

Questions?